

Amendments to th Claims

1. (currently amended) A metal structure for a contact pad of an integrated circuit having copper interconnecting metallization protected by an overcoat, comprising:

a portion of said copper metallization exposed by a window in said overcoat; said exposed copper having a clean surface;

A a patterned copper layer directly positioned on said clean copper metallization, whereby said metal structure has an electrical conductivity about equal to the conductivity of pure copper, said layer overlapping the perimeter of said overcoat window; and

a copper stud directly positioned on said copper layer, following the contours of said copper layer.

2. (original) The metal structure according to Claim 1 wherein said clean copper surface is free of copper oxide, organic residues, and contamination.

3. (original) The metal structure according to Claim 1 wherein said direct positioning of said copper layer on said clean copper pad provides the lowest possible electrical resistance and relinquishes the need for an intermediate barrier or under-bump layer.

4. (original) The metal structure according to Claim 1 wherein said copper layer has a thickness in the range from about 0.3 to 0.8 μm .

5. (original) The metal structure according to Claim 1 wherein said overcoat is a moisture-impermeable inorganic layer including silicon nitride and silicon oxynitride of approximately 1.0 μm thickness.

6. (original) The metal structure according to Claim 5 wherein said inorganic layer forms a perimeter around said window having a slope coverable by said copper layer.

7. (original) The metal structure according to Claim 1 wherein said overcoat is a sequence of an inorganic layer adjacent to the integrated circuit, overlaid by a polymeric layer including polyimide, benzocyclobutene, and polybenzoxazole of approximately 3.0 to 10.0 μm thickness, capable of absorbing thermomechanical stress.

A 8. (original) The metal structure according to Claim 7 wherein said sequence of layers forms a perimeter around said window having a slope coverable by said copper layer.

9. (original) The metal structure according to Claim 1 wherein said copper layer follows the contour of said perimeter of said overcoat window.

10. (original) The metal structure according to Claim 1 wherein said copper stud has a thickness in the range from about 10 to 20 μm and a width equal to the extent of said copper layer, following the contour of said perimeter of said overcoat window.

11. (currently amended) A structure for metallurgical connections between solder bumps and contact pads positioned on integrated circuits having copper interconnecting metallization protected by an overcoat, comprising:

a portion of said copper metallization exposed by a window in said overcoat;

said exposed copper having a clean surface;

a patterned copper layer directly positioned on said clean copper metallization, whereby said metal structure has an electrical conductivity about

equal to the conductivity of pure copper, said layer overlapping the perimeter of said overcoat window;

a copper stud directly positioned on said copper layer; and
one of said solder bumps bonded to said copper stud.

12. (original) The structure according to Claim 11 wherein said solder bumps are selected from a group consisting of tin, indium, tin/lead, tin/indium, tin/silver, tin/bismuth, conductive adhesives, and z-axis conductive materials.

Claims 13-18 (cancelled).

A 19. (new) An integrated circuit having copper interconnecting metallization protected by an overcoat, comprising:

a portion of said copper metallization exposed by a window in said overcoat;

a patterned copper layer directly positioned on said exposed clean copper metallization, said layer overlapping the perimeter of said overcoat window; and

a copper stud positioned on said copper layer and following the contours of said copper layer, said copper stud at least a factor of ten thicker than said copper layer.

20. (new) The integrated circuit of Claim 19 wherein said copper layer has a thickness in the range from about 0.3 to 0.8 μm .

21. (new) The integrated circuit of Claim 19 wherein said overcoat is a layer comprising silicon nitride.

22. (new) The integrated circuit of Claim 19 wherein said window in said overcoat has sloped sides.

23. (new) The integrated circuit of Claim 19 wherein said overcoat is a sequence of an inorganic layer adjacent to the integrated circuit, overlaid by a polymeric layer.

24. (new) The integrated circuit of Claim 19 wherein said copper layer follows the contour of said perimeter of said overcoat window.

25. (new) The integrated circuit of Claim 19 wherein said copper stud has a thickness in the range from about 10 to 20 μm and a width equal to the extent of said copper layer.

A
enc